TARGETING FOR NEUTRAL BEAMS

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Hywel White has produced a working plan for a first experimental target station (see report B.7-68-16) that incorporates two neutral beams, one at 2.5 milliradians and one at 5 milliradians. These neutral beams use the charged beam channels and can, therefore, use the charged beam magnets for sweeping. Alternatively, sweeping magnets can be incorporated farther down the muon shield with essentially no difficulty. These two neutral beams can be operated concurrently with the charged beams. Concurrent operation seems to be necessary during the early years of machine running unless a particular experiment is extremely interesting.

Longo has pointed out that the neutron spectrum produced at 0 milliradians is sharply peaked towards maximum neutron energies, whereas considerable deterioration in this peaking has taken place by 2.5 milliradians. By 5 milliradians, according to Hagedorn and Ranft, the spectrum peaks at only 1/2 maximum energy. The 2.5 milliradian beam proposed by White seems only barely adequate for Longo's purposes. For producing a neutron spectrum closer to 0 milliradians, it would be very useful to have a proton beam steering facility that could turn the beam on target. The small twist necessary to produce, say, 1.25 milliradian neutrons would still be well within the shielding capabilities of the muon shield.

K^o_L beams are a more difficult question. A glance at Fig. 3 of report B. 7-68-16 shows that no single angle is best for all energies of K^o_L. The 5-mrad beam in White's proposed targeting station would be adequate for some high energy (i.e. 100 GeV) K^o_L experiments. The curves of Fig. 3 do not tell the whole story. For some experiments, background from the highest energy neutrons will be very important, and this can be markedly reduced by going to larger angles. A beam at 10 mrad has more than adequate K^o_L intensity at least as high as 80 GeV, and those neutrons with energies above 140 GeV are decreased by a factor of 100 compared to a beam at 5 mrad, those above 120 GeV by a factor of 20.

It appears possible to thread a 12 mrad beam down White's setup by using the first two bending magnets of the 9.5 mrad channel as a neutral channel. Such an arrangement means turning the yokes around on some magnets of White's setup and changing the position of the drift space allowed between the magnets of the 2.5 mrad changed beam. This should be considered seriously before the final target layout is constructed.

Another alternative has been proposed by White that seems attractive in some ways. Neutral beams at any angle are available by taking them off at 0 mrad of azimuth and at the desired angle of elevation.

Even a 20 mrad beam would be only about 8 feet above the floor at 400 feet from the target. It should certainly be possible to engineer an experiment at this height. To retain this possibility care should be taken in any target station design to keep the 0 mrad azimuth clear of equipment.

Some thought has been given to hitting two different targets in the target station. This raises the possibility that some arrangement like that shown in Fig. 1 could be made so that a large angle neutral beam could go to the same neutral beam area as the 2.5 and 5.0 mrad beams.

K_L^o intensities are so high that if an experimenter were interested in lower energy K_L^o --say below 50 GeV--a really large angle beam of 30 mrad would still be useful. Such a beam would leave the side of the "Maschke Box," but such a neutral beam could easily penetrate 1 in. of steel at 30 mrad and still be useful. Care would be needed only to put a pipe through the target box shield wall and early part of the muon shield. A 30 mrad beam would leave the muon shield near its end. At least such a facility should be considered before any target station plan is made final.

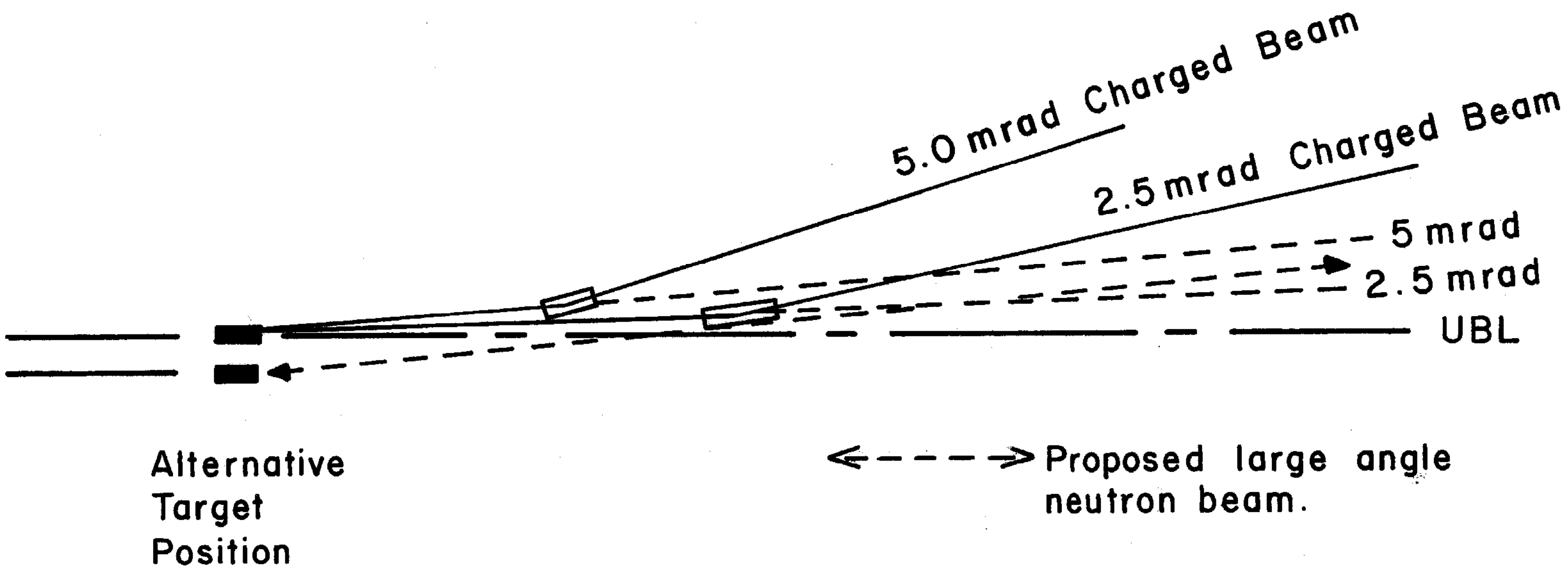

Fig. 1. Arrangement utilizing alternative proton targets to produce neutral beam in the same configuration as a charged beam.